Deriving Chemicals of High Concern
Process Documentation

Appendix III
Chemical Specific Inclusion Criteria
July 1, 2012

This document presents the rationale for inclusion and support for each chemical on the CHC list, as presented in the Maine CDC Chemicals of High Concern Process Documentation.

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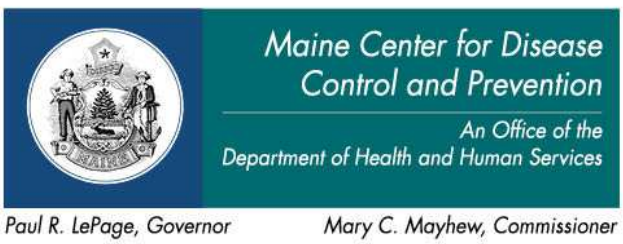

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Formaldehyde (CAS 50-00-0)

Criteria for inclusion of formaldehyde in the CHC List: IARC - Group 1 known human carcinogen.

The presence of formaldehyde in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of formaldehyde was identified in 5 indoor air and/or dust studies (preliminary literature search).

1. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
2. Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: concentrations and impact factors." Indoor Air 19: 206-217.
3. Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air 10: 178-192.
4. Koziel, J.,Noah, J.,Pawliszyn, J. (2001). "Field sampling and determination of formaldehyde in indoor air with solid-phase microextraction and on-fiber derivatization." Environmental Science & Technology 35: 1481-1486.
5. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.

Benzene (CAS 71-43-2)

Criteria for inclusion of benzene in the CHC List: NTP Report on Carcinogens - known carcinogen, EPA Integrated Risk Information System - 1986 criteria, known carcinogen, EPA Integrated Risk Information System – 1996 known carconogen, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen.

The presence of benzene in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives 114(8): 1210-1214.
3. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
4. Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epideniology 18: 421-429.
5. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.

6. Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives 113(3): 342-348.
7. Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives 114(3): 453-459.
8. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of benzene was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Adgate, J. L.,Church, T. R.,Ryan, A. D.,Ramachandran, G.,Fredrickson, A. L.,Stock, T. H.,Morandi, M. T.,Sexton, K. (2004). "Outdoor, indoor and personal exposure to VOCs in children." Environmental Health Perspectives 112(14): 1386-1392.
2. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
3. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
4. Liu, J.,Drane, W.,Liu, X.,Wu, T. (2009). "Examination of the relationships between environmental exposures to volatile organic compounds and biochemical liver tests: application of canonical correlation analysis." Environmental Research 109(2): 193-199.
5. Miller, S. L.,Branoff, S.,Nazaroff, W. W. (1998). "Exposure to toxic air contaminants in environmental tobacco smoke: An assessment for California based on personal monitoring data." Journal of Exposure Analysis and Environmental Epidemiology 8(3): 287-311.
6. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
7. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
8. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
9. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Vinyl chloride (CAS 75-01-4)

Criteria for inclusion of vinyl chloride in the CHC List: NTP Report on Carcinogens - known carcinogen, EPA Integrated Risk Information System - 1986 criteria, known carcinogen, EPA Integrated Risk Information System - 1996, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen, Global Harmonization System - Category 1A known human carcinogen.

The presence of vinyl chloride in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of vinyl chloride was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Tetrabromobisphenol A (CAS 79-94-7)

Criteria for inclusion of tetrabromobisphenol A in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. A review by the Maine CDC identified about two dozen studies documenting effects on reproductive, developmental, endocrine, or cancer endpoints. Studies were also identified with data on levels of TBBPA in humans.

1. Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Brominated Flame Retardants as a Priority Chemical, November 22, 2010

The presence of tetrabromobisphenol A in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
2. Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology 36(7): 1414-1418.

The presence of tetrabromobisphenol A was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

Dicyclohexyl phthalate; DCHP (CAS 84-61-7)

Criteria for inclusion of dicyclohexyl phthalate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of dicyclohexyl phthalate in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

The presence of dicyclohexyl phthalate was identified in 4 indoor air and/or dust studies (preliminary literature search).

1. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
2. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
3. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.

4. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Diethyl phthalate (CAS 84-66-2)

Criteria for inclusion of diethyl phthalate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of diethyl phthalate in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
4. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
5. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
6. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
7. Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives 118(6): 825-832.
8. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of diethyl phthalate was identified in 10 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.

3. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.
4. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
5. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
6. Just, A. C.,Adibi, J. J.,Rundle, A. G.,Calafat, A. M.,Camann, D.,Hauser, R.,Silva, M. J.,Whyyatt, R. M. (2010). "Urinary and air phthalate concentrations and self-reported use of personal care products among minority pregnant women in New York city." Journal of Exposure Science and Environmental Epideniology 20: 625-633.
7. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
8. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
9. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
10. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Dibutyl phthalates; DBP (CAS 84-74-2)

Criteria for inclusion of DBP (dibutyl phthalates) in the CHC List: NTP – clear evidence of adverse reproductive and developmental effects, EU Endocrine Disruptor Program - Category 1 probable.

The presence of DBP (dibutyl phthalates); di-n-butyl phthalate in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
4. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
5. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
6. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

7. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121
8. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of DBP (dibutyl phthalates); di-n-butyl phthalate was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
3. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.
4. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
5. Just, A. C.,Adibi, J. J.,Rundle, A. G.,Calafat, A. M.,Camann, D.,Hauser, R.,Silva, M. J.,Whyyatt, R. M. (2010). "Urinary and air phthalate concentrations and self-reported use of personal care products among minority pregnant women in New York city." Journal of Exposure Science and Environmental Epideniology 20: 625-633.
6. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
7. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
8. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
9. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Di-n-Hexyl phthalate (CAS 84-75-3)

Criteria for inclusion of di-n-hexyl phthalate in the CHC List: NTP – clear evidence of adverse reproductive effects.

The presence of di-n-hexyl phthalate in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of di-n-hexyl phthalate was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Benzyl butyl phthalate; Butyl benzyl phthalate; BBzP (CAS 85-68-7)

Criteria for inclusion of Benzyl butyl phthalate; BBP in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of benzyl butyl phthalate; BBP in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
4. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
5. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
6. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
7. Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives 118(6): 825-832.
8. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of butyl benzyl phthalate; BBP was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
3. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.

4. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
5. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
6. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
7. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
8. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
9. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Hexachlorobutadiene (CAS 87-68-3)

Criteria for inclusion of hexachlorobutadiene in the CHC List: Canadian Environmental Protection Act - PersistentBioaccumulative & Inherently Toxic,

The presence of hexachlorobutadiene in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of hexachlorobutadiene was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

2-Naphthylamine (CAS 91-59-8)

Criteria for inclusion of 2-naphthylamine in the CHC List: NTP Report on Carcinogens - known carcinogen, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen.

The presence of 2-naphthylamine in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-naphthylamine was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Wilson, W. E.,Lioy, P. J. (1994). "Sources of organic acids in indoor air: a field study." Journal of Exposure Analysis and Environmental Epidemiology 4(1): 25-47.

4-Hydroxybiphenyl; (CAS 92-69-3)

Criteria for inclusion of 4-hydroxybiphenyl in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 4-hydroxybiphenyl in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.
3. Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta 622:150-156.

The presence of 4-hydroxybiphenyl; 4-phenylphenol was not identified in indoor air and/or dust studies (preliminary literature search).

Benzidine and its salts (CAS 92-87-5)

Criteria for inclusion of benzidine and its salts in the CHC List: EPA Integrated Risk Information System - 1986 criteria, known carcinogen, IARC - Group 1 known human carcinogen.

The presence of benzidine and its salts in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of benzidine and its salts was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Propyl paraben (CAS 94-13-3)

Criteria for inclusion of propyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of propyl paraben in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.

2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.
3. Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta 622:150-156.

The presence of propyl paraben was not identified in indoor air and/or dust studies (preliminary literature search).

Butyl paraben (CAS 94-26-8)

Criteria for inclusion of butyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of butyl paraben in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.

The presence of butyl paraben was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

2-Aminotoluene (CAS 95-53-4)

Criteria for inclusion of 2-aminotoluene in the CHC List: IARC - Group 1 known human carcinogen.

The presence of 2-aminotoluene in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-aminotoluene was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Methyl paraben (CAS 99-76-3)

Criteria for inclusion of methyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of methyl paraben in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.
3. Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta 622:150-156.

The presence of methyl paraben was identified in 1 indoor air and/or dust study (preliminary literature search).

1. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

p-Hydroxybenzoic acid (CAS 99-96-7)

Criteria for inclusion of p-hydroxybenzoic acid in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of p-hydroxybenzoic acid in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of p-hydroxybenzoic acid was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Styrene (CAS 100-42-5)

Criteria for inclusion of styrene in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of styrene in humans was identified in 5 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.

2. Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives 114(8): 1210-1214.
3. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
4. Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives 113(3): 342-348.
5. Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives 114(3): 453-459.

The presence of styrene was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology 36(7): 1414-1418.
2. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
3. Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: concentrations and impact factors." Indoor Air 19: 206-217.
4. Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air 10: 178-192.
5. Miller, S. L.,Branoff, S.,Nazaroff, W. W. (1998). "Exposure to toxic air contaminants in environmental tobacco smoke: An assessment for California based on personal monitoring data." Journal of Exposure Analysis and Environmental Epidemiology 8(3): 287-311.
6. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
7. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
8. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
9. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

4,4´-Methylenebis(2-Chloroaniline) (CAS 101-14-4)

Criteria for inclusion of 4,4´-methylenebis(2-chloroaniline) in the CHC List: IARC - Group 1 known human carcinogen.

The presence of 4,4´-methylenebis(2-chloroaniline) in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 4,4´-methylenebis(2-chloroaniline) was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Epichlorohydrin (CAS 106-89-8)

Criteria for inclusion of epichlorohydrin in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of epichlorohydrin in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of epichlorohydrin was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

1,2-Dibromoethane (CAS 106-93-4)

Criteria for inclusion of 1,2-dibromoethane in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 1,2-dibromoethane in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 1,2-dibromoethane was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

1,3-Butadiene (CAS 106-99-0)

Criteria for inclusion of 1,3-butadiene in the CHC List: NTP Report on Carcinogens - known human carcinogen, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen.

The presence of 1,3-butadiene in humans was identified in 1 biomonitoring study (preliminary literature search).

1. Schettgen, T.,Musiol, A.,Alt , E.,Ochsmann, E. (2009). "A Method for the quantification of biomarkers of exposure to acrylonitrile and 1, 3-butadiene in human urine by column-switching liquid chromatography- tandem mass spectrometry." Analytical and Bioanalytical Chemistry 393: 969-981.

The presence of 1,3-butadiene was identified in 4 indoor air and/or dust studies (preliminary literature search).

1. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
2. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
3. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
4. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Toluene (CAS 108-88-3)

Criteria for inclusion of toluene in the CHC List: Global Harmonization System - category 1A for known reproductive or germ cell mutagenicity.

The presence of toluene in humans was identified in 8 biomonitoring studies (preliminary literature search.

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives 114(8): 1210-1214.
3. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
4. Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epideniology 18: 421-429.
5. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
6. Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives 113(3): 342-348.

7. Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives 114(3): 453-459.
8. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of toluene was identified in 10 indoor air and/or dust studies (preliminary literature search).

1. Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology 36(7): 1414-1418.
2. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
3. Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: concentrations and impact factors." Indoor Air 19: 206-217.
4. Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air 10: 178-192.
5. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
6. Liu, J.,Drane, W.,Liu, X.,Wu, T. (2009). "Examination of the relationships between environmental exposures to volatile organic compounds and biochemical liver tests: application of canonical correlation analysis." Environmental Research 109(2): 193-199.
7. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
8. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
9. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
10. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Tris (2-chloroethyl) phosphate (CAS 115-96-8)

Criteria for inclusion of tris (2-chloroethyl) phosphate in the CHC List: Canadian Environmental Protection Act – Persistent bioaccumulative & inherently toxic.

The presence of tris(2-chloroethyl) phosphate in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of tris(2-chloroethyl) phosphate was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. HÅkan Carlsson, Ulrika Nilsson, Gerhard Becker, and Conny Östman (1997) Organophosphate Ester Flame Retardants and Plasticizers in the Indoor Environment: Analytical Methodology and Occurrence. Environ. Sci. Technol., 1997, 31 (10), pp 2931-2936
2. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.

Di-(2-ethylhexyl) phthalate; DEHP (CAS 117-81-7)

Criteria for inclusion of DEHP (di-(2-ethylhexyl) phthalate) in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of DEHP (di-(2-ethylhexyl) phthalate); bis(2-ethylhexyl) phthalate in humans was identified in 9 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. Becker, K.,Seiwert, M.,Angerer, J.,Heger, W.,Koch, H. M.,Nagorka, R.,Robkamp, E.,Schluter, C.,Seifert, B.,Ullrich, D. (2004). "DEHP matabolites in urine of children and DEHP in house dust." International journal of Environmental Health 2007: 409-417.
4. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
5. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
6. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
7. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

8. Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives 118(6): 825-832.
9. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of DEHP (di-(2-ethylhexyl) phthalate); bis(2-ethylhexyl) phthalate was identified in 10 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
3. Becker, K.,Seiwert, M.,Angerer, J.,Heger, W.,Koch, H. M.,Nagorka, R.,Robkamp, E.,Schluter, C.,Seifert, B.,Ullrich, D. (2004). "DEHP matabolites in urine of children and DEHP in house dust." International journal of Environmental Health 2007: 409-417.
4. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.
5. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
6. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
7. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
8. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
9. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
10. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Hexachlorobenzene (CAS 118-74-1)

Criteria for inclusion of hexachlorobenzene in the CHC List: EU Endocrine Disruptor Program - Category 1 probable, Global Harmonization System - Category 1A for known reproductive or germ cell mutagenicity.

The presence of hexachlorobenzene in humans was identified in 7 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.

2. Damgaard, I. N.,Skakkebaek, N. E.,Toppari, J.,Virtanen, H. E.,Shen, H.,Schramm, K. W.,Petersen, J. H.,Jensen, T. K.,Main, K. M.,Group, T. N. C. S. (2006). "Persistent pesticides in human breast milk and cryptorchidism." Environmental Health Perspectives 114(7): 1133-1138.
3. Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives 109(12): 1291-1299.
4. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
5. Ribas-Fitó, N.,Torrent, M.,Carrizo, D.,Júlvez, J.,Grimalt, J. O.,Sunyer, J. (2007). "Exposure to hexachlorobenzene during pregnancy andcChildren's social behavior at 4 years of age." Environmental Health Perspectives 115(3): 447-450.
6. Shen H, Main K, Andersson A, Damgaard I, Helena E. Virtanen H, Skakkebaek E, Toppari J, and Schramm K (2008). Concentrations of persistent organochlorine compounds in human milk and placenta are higher in Denmark than in Finland. Human Reproduction Vol.23, No.1 pp. 201–210
7. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of hexachlorobenzene was not identified in indoor air and/or dust studies (preliminary literature search).

Ethyl paraben (CAS 120-47-8)

Criteria for inclusion of ethyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of ethyl paraben in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.

The presence of ethyl paraben was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Camann R, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553

Benzophenone-2; (Bp-2), 2,2',4,4'-tetrahydroxybenzophenone (CAS 131-55-5)

Criteria for inclusion of benzophenone-2 (BP-2), 2,2',4,4'-tetrahydroxybenzophenone in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of benzophenone-2 (BP-2), 2,2',4,4'-tetrahydroxybenzophenone in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of benzophenone-2 (BP-2), 2,2',4,4'-tetrahydroxybenzophenone was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

2,4-Dihydroxybenzophenon; Resbenzophenone (CAS 131-56-6)

Criteria for inclusion of 2,4-dihydroxybenzophenon; resbenzophenone in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 2,4-dihydroxybenzophenon; resbenzophenone in humans was identified in 1 biomonitoring study (preliminary literature search).

1. Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives 109(12): 1291-1299.

The presence of 2,4-dihydroxybenzophenon; resbenzophenone was not identified in indoor air and/or dust studies (preliminary literature search).

Mono-n-butylphthalate (CAS 131-70-4)

Criteria for inclusion of mono-n-butylphthalate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of mono-n-butylphthalate in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
2. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121
3. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of mono-n-butylphthalate was not identified in indoor air and/or dust studies (preliminary literature search).

4-tert-Octylphenol; 1,1,3,3-Tetramethyl-4-butylphenol (CAS 140-66-9)

Criteria for inclusion of 4-tert-octylphenol; 1,1,3,3-tetramethyl-4-butylphenol in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 4-tert-octylphenol; 1,1,3,3-tetramethyl-4-butylphenol in humans was identified in 5 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Wong, L. Y.,Silva, M. J.,Samandar, E.,Preau, J. L. J.,Jia, L. T.,Needham, L. L. (2011). "Selecting adequate exposure biomarkers of diisononyl and diisodecyl phthalates: Data from the 2005-2006 National Health and Nutrition Examination Survey." Environmental Health Perspectives 119(1): 50-55.
2. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
3. Chen, G. W.,Ding, W. H.,Ku, H. Y.,Chao, H. R.,Chen, H. Y.,Huang, M. C.,Wang, S. L. (2010). "Alkylphenols in human milk and their relations to dietary habits in Central Taiwan " Food and Chemical Toxicology 48: 1939-1944.
4. Lopez-Espinosa, M. J.,Freire, C.,Arrebola, J. P.,Navea, N.,Taoufiki, J.,Fernandez, M. K.,Ballesteros, O.,Prada, R.,Olea, N. (2009). "Nonylphenol and octylphenol in adipose tissue of women in Southern Spain." Chemosphere 76: 847-852.
5. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of 4-tert-octylphenol; 1,1,3,3-tetramethyl-4-butylphenol was not identified in indoor air and/or dust studies (preliminary literature search).

Octamethylcyclotetrasiloxane (CAS 556-67-2)

Criteria for inclusion of octamethylcyclotetrasiloxane in the CHC List: EU Endocrine Disruptor Program - Category 1 probable, Canadian Environmental Protection Act – persistent bioaccumulative & inherently toxic.

The presence of octamethylcyclotetrasiloxane in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of octamethylcyclotetrasiloxane was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Lu, Y.,Yuan, T.,Yun, S. H.,Wang, W.,Gian Wu, G.,Kannan, K. (2010). "Occurrence of cyclic and lsnear Siloxanes in indoor dust from China, and implications for human exposures." Environmental Science Technology 44(16): 6081-6087.

Benzene, pentachloro- (CAS 608-93-5)

Criteria for inclusion of benzene, pentachloro- in the CHC List: EU Endocrine Disruptor Program - Category 1 probable, Canadian Environmental Protection Act - PersistentBioaccumulative & Inherently Toxic.

The presence of benzene, pentachloro- in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Damgaard, I. N.,Skakkebaek, N. E.,Toppari, J.,Virtanen, H. E.,Shen, H.,Schramm, K. W.,Petersen, J. H.,Jensen, T. K.,Main, K. M.,Group, T. N. C. S. (2006). "Persistent pesticides in human breast milk and cryptorchidism." Environmental Health Perspectives 114(7): 1133-1138.
2. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

The presence of benzene, pentachloro- was not identified in indoor air and/or dust studies (preliminary literature search).

2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether; BDE-209 (CAS 1163-19-5)

Criteria for inclusion of 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether; BDE-209 in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. Reports to the Maine State Legislature by the MEDEP and MECDC reviewed numerous peer-reviewed studies documenting adverse endocrine and developmental effects of deca BDE, including effects on thyroid hormones and developmental neurotoxicity.[1]

The presence of 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether; BDE -209 in humans was identified in 1 biomonitoring studiy (preliminary literature search).

1. Gomara, B.,Herrero, L.,Ramos, J. J.,Mateo, J. R.,Fernández, M. A.,Garcıa, J. F.,González, M. J. (2007). "Distribution of polybrominated diphenyl ethers in human umbilical cord serum, Paternal serum, maternal serum, placentas, and breast milk from Madrid population, Spain." Environmental Science & Technology 41(20): 6961-6968.

The presence of 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether; BDE -209 was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. Allen, J. G.,McClean, M. D.,Stapleton, H. M.,Nelson, J. W.,Webster, T. F. (2007). "Personal exposure to polybrominated diphenyl ethers (PBDEs) in residential indoor air." Environmental Science & Technology 41(13): 4574-4579.

[1] Brominated Flame Retardants: A Report to the Joint Standing Committee on Natural Resources, 122nd Maine Legislature, Prepared by: Maine Bureau of Health (now the Maine Center for Disease Control and Prevention) and the Maine Department of Environmental Protection, February 2005. Brominated Flame Retardants: A report to the Committee on Natural Resources, 122nd Maine Legislature, Prepared by the Center for Disease Control and Prevention and Department of Environmental Protection, February 2006. Brominated Flame Retardants: Third annual report to the Maine Legislature, Prepared by the Maine Center for Disease Control & Prevention and the Maine Department of Environmental Protection, January 2007.

2. Zhu, J.,Newhook, R.,Marro, L.,Chan, C. C. (2005). "Selected volatile organic compounds in residential air in the City of Ottawa, Canada." Environmental Science & Technology 39(11): 3964-3971.

Methyl tert-butyl ether; MTBE (CAS 1634-04-4)

Criteria for inclusion of methyl tert-butyl ether; MTBE in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of methyl tert-butyl ether; MTBE in humans was identified in 4 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
3. Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epideniology 18: 421-429.
4. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of methyl tert-butyl ether; MTBE was identified in 4 indoor air and/or dust studies (preliminary literature search).

1. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
2. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
3. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
4. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Perfluorooctanyl sulphonic acid and its salts; PFOS (CAS 1763-23-1)

Criteria for inclusion of perfluorooctanyl sulphonic acid and its salts; PFOS in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. As part of ongoing review of PFOS at MECDC, a recent scientific publication was identified that reported serum levels perfluorooctane sulfonate were positively associated with chronic kidney disease.[2] The authors examined the relation of serum PFOS (and PFOA) and chronic kidney disease in 4,587 adult participants from combined National Health and Nutritional Examination Surveys for whom serum measurements were available. The association was independent of confounders such as age, sex, race/ethnicity, body mass index, diabetes, hypertension, and serum cholesterol level. It is also noteworthy that the European Union designates PFOS as persisitent, bioaccumulative, and toxic to mammalian species, and recommends ultimate phase-out.[3]

[2] Shankar, Anoop; Jie Xiao and Alan Ducatman (2011-10-15). "Perfluoroalkyl Chemicals and Chronic Kidney Disease in US Adults". American Journal of Epidemiology 174 (8): 893–900.

[3] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0032:0034:en:PDF

The presence of perfluorooctanyl sulphonic acid and its salts; PFOS in humans was identified in 5 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Fei, C.,McLaughlin, J. K.,Tarone, R. E.,Olsen, J. (2007). "Perfluorinated chemicals and fetal growth: A study within the Danish National Birth Cohort." Environmental Health Perspectives 115(11): 1677-1682.
3. Haug, L. S.,Huber, S.,Becher, G.,Thomsen, C. (2011). "Characterisation of human exposure pathways to perflourinated compounds - comparing exposure estimates with biomarkers of exposure." Environmental International 37: 687-693.
4. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
5. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of perfluorooctanyl sulphonic acid and its salts; PFOS was identified in 3 indoor air and/or dust studies (preliminary literature search).

1. Bjorklund, J. A.,Thuresson, K.,De Wit, C. A. (2009). "Perfluoroalkyl compounds (PFCs) in indoor dust: Concentrations, human exposure estimates, and sources." Environmental Science & Technology 43(7): 2276-2281.
2. Haug, L. S.,Huber, S.,Becher, G.,Thomsen, C. (2011). "Characterisation of human exposure pathways to perflourinated compounds - comparing exposure estimates with biomarkers of exposure." Environmental International 37: 687-693.
3. Shoeib, M.,Harner, T.,Webster, G. M.,Lee , S. C. (2011). "Indoor sources of poly- and perfluorinated compounds (PFCS) in Vancouver, Canada: Implications for human exposure." Environmental Science and Technology 45 (19): 7999-8005

Phenol, 4-octyl- (CAS 1806264)

Criteria for inclusion of phenol, 4-octyl- in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of phenol, 4-octyl- in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Ye, X.,Kuklenyik, Z.,Needham, L. L.,Calafat, A. M. (2005). "Automated on-line column-switching HPLC_MS/MS method with peak focusing for the determination of nine environmental phenols in urine." Analytica Chemistry 77(16): 5407-5413.

The presence of phenol, 4-octyl- was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

2-Naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- (CAS 2425856)

Criteria for inclusion of 2-naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- in the CHC List: Canadian Environmental Protection Act – persistent bioaccumulative & inherently toxic.

The presence of 2-naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

2-Ethyl-hexyl-4-methoxycinnamate (CAS 5466773)

Criteria for inclusion of 2-ethyl-hexyl-4-methoxycinnamate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 2-ethyl-hexyl-4-methoxycinnamate in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-ethyl-hexyl-4-methoxycinnamate was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Mercury & mercury compounds (CAS 7439976)

Criteria for inclusion of mercury & mercury compounds in the CHC List: Global Harmonization System - category 1A for known reproductive or germ cell mutagenicity, California Prop65 - developmental effects (substantiated by ME-CDC review), Washington State PBT Program (confirmed by ME-CDC).

The presence of mercury & mercury compounds in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives 109(12): 1291-1299.
3. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of mercury & mercury compounds was identified in 1 indoor air and/or dust study (preliminary literature search).

1. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.

Nickel & nickel compounds (CAS 7440020)

Criteria for inclusion of nickel & nickel compounds in the CHC List: NTP Report on Carcinogens – nickel compounds are known human carcinogens; metallic nickel is reasonably anticipated to cause cancer I humans.

The presence of nickel & nickel compounds in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Bernhard, D.,Rossmann, A.,Henderson, B.,Kind, M.,Seubert, A.,Wick , G. (2006). "Increased serum Cadmium and Strontium Levels in Young Smokers - Effects on Arterial Endothelial Cell Gene Transcription." Arterioscler Thrombosis Vascular Biology 26:833-838.
2. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
3. Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A 73: 878-887.

The presence of nickel & nickel compounds was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in household." Reviews on Environmental Health 11(4): 179-189.
2. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.

Arsenic & Arsenic compounds (CAS 7440382)

Criteria for inclusion of arsenic & arsenic compounds in the CHC List: NTP Report on Carcinogens - known human carcinogen, EPA Integrated Risk Information System - 1986 criteria, known carcinogen, IARC - Group 1 known human carcinogen, Global Harmonization System - category 1A known human carcinogen, Global Harmonization System - category 1A for known reproductive or germ cell mutagenicity.

The presence of arsenic & arsenic compounds in humans was identified in 6 biomonitoring studies (preliminary literature search).

1. Caldwell K, Jones R, Verdon C, Jarrett J, Caudill S and Osterloh J (2008). Levels of urinary total and speciated arsenic in the US population: National Health and Nutrition Examination Survey 2003–2004. Journal of Exposure Science and Environmental Epidemiology (2009) 19, 59–68.
2. Clayton, C.,Pellizzari, E.,Quackenboss, J. (2002). "National Human Exposure Assessment Survey: Analysis of exposure pathways and routes for arsenic and lead in EPA Region 5." Journal of Exposure Analysis and Environmental Epidemiology 12(1): 29-43.
3. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
4. Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A 73: 878-887.

5. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
6. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.

The presence of arsenic & arsenic compounds was identified in 5 indoor air and/or dust studies (preliminary literature search).

1. Clayton, C.,Pellizzari, E.,Quackenboss, J. (2002). "National Human Exposure Assessment Survey: Analysis of exposure pathways and routes for arsenic and lead in EPA Region 5." Journal of Exposure Analysis and Environmental Epidemiology 12(1): 29-43.
2. Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in household." Reviews on Environmental Health 11(4): 179-189.
3. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
4. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
5. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.

Beryllium & Beryllium compounds (CAS 7440417)

Criteria for inclusion of beryllium & beryllium compounds in the CHC List: NTP Report on Carcinogens - known human carcinogen, EPA Integrated Risk Information System – 1996 B1 probable human carcinogen, IARC - Group 1 known human carcinogen, Global Harmonization System – Category 1A known human carcinogen.

The presence of beryllium & beryllium compounds in humans was identified in 4 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
3. Navas-Acien, A.,Francesconi, K. A.,Silbergeld, E. K.,Guallar, E. (2011). "Seafood intake and urine concentrations of total arsenic, dimethlyarsinate and arsenobetaine in the US population." Environmental Research 111: 110-118.

4. Shirai, S.,Suzuki, Y.,YOshinaga, J.,Mizumoto, Y. (2010). "Maternal exposure to low-level heavy metals during pregnancy and birth size." Journal of Environmental Science and Health Part A 45: 1468-1474.

The presence of beryllium & beryllium compounds was not identified in indoor air and/or dust studies (preliminary literature search).

Cadmium (CAS 7440-43-9)

Criteria for inclusion of cadmium in the CHC List: NTP Report on Carcinogens - known human carcinogen, IARC - Group 1 known human carcinogen

The presence of cadmium in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Bernhard, D.,Rossmann, A.,Henderson, B.,Kind, M.,Seubert, A.,Wick , G. (2006). "Increased serum Cadmium and Strontium Levels in Young Smokers - Effects on Arterial Endothelial Cell Gene Transcription." Arterioscler Thrombosis Vascular Biology 26:833-838.
2. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
3. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
4. Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A 73: 878-887.
5. Padilla, M. A.,Elobeid, M.,Ruden, D. M.,Allison, D. B. (2010). "An examination of the association of selected toxic metals with total and central obesity indices: NHANES 99-02." International Journal of Environmental Research and Public Health 7: 3332-3347.
6. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
7. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.
8. Shirai, S.,Suzuki, Y.,YOshinaga, J.,Mizumoto, Y. (2010). "Maternal exposure to low-level heavy metals during pregnancy and birth size." Journal of Environmental Science and Health Part A 45: 1468-1474.

The presence of cadmium was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in household." Reviews on Environmental Health 11(4): 179-189.
2. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.

Quartz (CAS 14808-60-7)

Criteria for inclusion of quartz in the CHC List: IARC - Group 1 known human carcinogen, Global Harmonization System - Category 1A known human carcinogen.

The presence of quartz in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of quartz was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Butylated hydroxyanisole (CAS 25013-16-5)

Criteria for inclusion of butylated hydroxyanisole in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of butylated hydroxyanisole in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of butylated hydroxyanisole was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Hexabromocyclododecane; HBCD (CAS 25637-99-4)

Criteria for inclusion of hexabromocyclododecane in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. Maine CDC documents peer-reviewed studies reporting endocrine and developmental effects of HBCD, including developmental neurotoxicity in humans. Studies were also identified with data on levels of HBCD in humans.[4] It is also noteworthy that the US EPA has an action plan for HBCD based on concerns for reproductive, developmental, and neurological effects.[5]

The presence of hexabromocyclododecane in humans was identified in one biomonitoring study (preliminary literature search).

1. Covaci, A.,Gerecke, A. C.,Law, R. J.,Voorspoels, S.,Kohler, M.,Heeb, N. V.,Leslie, H.,Allchin, C. R.,Deboer, J. (2006). "Hexabromocyclododecanes (HBCDs) in the environment and humans: A review." Environmental Science & Technology 40(12): 3679-3688.

The presence of hexabromocyclododecane was identified in 2 indoor air and/or dust studies (preliminary literature search).

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[4] Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Brominated Flame Retardants as a Priority Chemical, November 22, 2010

[5] http://www.epa.gov/existingchemicals/pubs/actionplans/hbcd.html.

1. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
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Phenol, (1,1,3,3-tetramethylbutyl)-; Octylphenol (CAS 27193-28-8)

Criteria for inclusion of phenol, (1,1,3,3-tetramethylbutyl)-; octylphenol in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of phenol, (1,1,3,3-tetramethylbutyl)-; octylphenol in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of phenol, (1,1,3,3-tetramethylbutyl)-; octylphenol was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.